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THREE NEW CLAIBORNE FOSSILS

By W. STORRS COLE

March 14, 1929

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INTRODUCTION

The material in which the new forms described in this paper were found, was collected by Mr. A. C. Veatch during his survey of the Sabine River, in the year 1900. (See Louisiana Geol. Surv., Report of 1902.)

The matrix is a fossiliferous, oolitic, green sand which weathers to a dark, reddish brown. It contains many small Molluscs which are in an exceedingly poor state of preservation. There are a few which retain enough of their characteristics to permit specific determination. It is on these, that I am basing my stratigraphic deductions.

Lepidocyclina (*Polylepidina*) *gardneræ* Cole, n. sp. is very abundant, but *Operculinella sabinensis* Cole, n. sp. and *Mytilus gilbertharrisi* Cole, n. sp. are represented by only a few specimens. Because of the great number of individuals of this species of *Lepidocyclina*, together with its considerably better state of preservation than the other fossils from this horizon, it should make a good stratigraphic marker for these beds.

Only one horizon is represented by the samples which I have, so nothing can be said in regard to the probable vertical or horizontal distribution of these species. No other Foraminifera have been found up to this date from the material now at hand.

Dr. Vaughan, who kindly examined specimens of *L. gardneræ* for me and to whom I owe my thanks for checking this manuscript, suggested that this species is very similar to sections he has of *L. antillea* Cushman, but not identical with it. At the same time he very kindly sent me a carbon copy of an article of his on the nomenclature of *Lepidocyclina* which is to appear in the March number of the Journal of Paleontology.

After reading this article with considerable care, I am convinced that Vaughan offers enough proof, so that the well-known name *Lepidocyclina* should be retained, in preference to *Cyclosiphon*.

DESCRIPTION OF SPECIES

Order FORAMINIFERA d'Orbigny

Genus LEPIDOCYCLINA Gümbel

Subgenus POLYLEPIDINA Vaughan

Lepidocyclina (Polylepidina) gardneræ Cole, n. sp.

Plate 1, figs. 1-6; Plate 2, figs. 1, 2

Test circular, not sellæform, varying from biconvex to planoconvex, most specimens being biconvex; pustulate, the pustules being particularly numerous in the umbilical region. The largest specimen measured 8.2 mm. in diameter and is a microspheric form; the smallest specimen measured 2.8 mm. and is a megalospheric specimen. The average diameter is about 6 mm. Thickness through the center averages about 1.3 mm. in microspheric forms.

Most specimens do not exhibit a distinct umbonate area, rather an even thinning from a central high point to the periphery. Some few specimens, however, have a distinct raised portion which is demarked from the remainder of the test by a definite line. This raised portion when present, occupies about one-half the total surface area of the test.

In horizontal section, the median chambers arcuate, with the outer wall curved and usually with slightly truncated proximal ends.

In vertical section, the lateral chambers appear irregular, both as to size and spacing. In some specimens the lateral chambers appear to be missing, due to the fact that the chamber walls are directly superimposed with cavity between, missing. When the lateral chambers are present, they appear to be about 3 times as long as wide. There is generally a layer of shell material between the rows of lateral chambers when they are present which is about twice as wide as the chambers, themselves. The pillars whose outer ends represent the pustules are distinctly present in all sections. The line of equatorial chambers is distinct, the chambers in the center being the smallest, growing gradually larger as they reach the periphery, altho they never

occupy the entire width of the test.

The nucleoconch of the megalospheric form, consists generally of 5 chambers, a large one with four smaller ones partially surrounding it. The entire embryonic apparatus is roughly circular in shape with the chambers which surround the large central one gradually decreasing in size until they form the true equatorial chambers. The diameter of the large central chamber is 0.231 mm.; the diameter of the entire nucleoconch is 0.33 mm. Walls of the embryonic chambers thicker than those of the median chambers.

In horizontal sections of the microspheric forms, the nucleoconch is coiled, the chambers gradually enlarging, making about three and one-half volutions. In most sections examined, of microspheric specimens, the nucleoconch seems to form a cone which appears rather distinctly from one side or the other of the section. The apex of the cone is formed by the initial chamber. Whether this is globular or not, I have not been able to decide. By the time the embryonic chambers have reached the general plane of the equatorial chambers, they have become full-sized equatorial chambers. The equatorial chambers gradually increase in size as they approach the periphery of the test.

The chamber wall is composed of three distinct parts, a dark inner portion bordered by lighter outer portions. The dark inner portion is wider than the combined width of the lighter portions.

There appear to be 3 openings which occur in the corners of each chamber.

L. antillea as suggested by Dr. Vaughan, appears to be the nearest to this new form. The embryonic apparatus of *L. antillea* has not been published to date. For a comparison, therefore, the most striking differences appear in the vertical sections. *L. antillea* in the published vertical section has large, easily recognized lateral chambers and slightly different appearing median chambers. *L. antillea* also is reported to have about 6 layers of lateral chambers, but *L. gardneræ* has only 4 when they are present.

Locality.—Cooper's Mill, one and one-half miles south of Sabinetown, Texas.

Cotypes.— My personal collection.

Horizon.— St. Maurice Eocene.

Associated with *L. gardnera* are the following Mollusca:

Ostrea vicksburgensis ludoviciana Harris (common)

Amussium squamulum Lam. (abundant)

Semele linosa, var. (see Bull. Amer. Pal., vol. VI, No. 31, p. 171, pl. 52, fig. 5a, 1919) (very rare)

Arca rhomboidella Lea (rare)

Venericardia rotunda funiculus Harris (or very near this variety)

Natica (*Neverita*) *limula* Conrad

Mytilus gilbertharrisi Cole, n. sp.; and one coral:

Endopachys machurii tenue Vaughan

This species is named in honor of Dr. Julia Gardner of the U. S. Geological Survey, Washington, D. C.

Genus OPERCULINELLA Yabe

Operculinella sabinensis Cole, n. sp.

Plate 2, figs. 5, 6

Test small, biconvex, consisting of 24 - 26 chambers in the final volution. Thickest in the umbilical area, gradually thinning to the periphery which is bluntly rounded. Surface and sutures without ornamentation except for a very few small raised clear beads of shell material directly over the umbilicus. Sutures show only indistinctly through the shell wall. Sutures distinctly arcuate and wavy. About 5 volutions comprise an adult test.

Diameters nearly equal 3.6 mm.

Locality.— Cooper's Mill, one and one-half miles south of Sabinetown, Texas.

Cotypes.— My personal collection.

Horizon.— Horizon of *L. gardnera*, St. Maurice Eocene,

This species is nearest *O. willcoxi* (Heilprin) from the Ocala limestone, but differs in the smaller number of chambers, smaller size and greater wave-like appearance of the sutures.

Order PRIONODESMACEA Dall

Genus MYTILUS Linn.

Mytilus gilbertharrisi Cole, n. sp.

Plate 2, figs. 3, 4

Shell elongated, oblong. Beaks terminal, small; umbones

prominent, though small; posterior end regularly rounded; anterior end also fairly regularly rounded, almost as broad as the posterior end; cardinal margin straight with a channel-like depression extending between this margin and the umbonal ridge; umbonal ridge slightly prominent. Surface with numerous indistinct, radiating striæ.

Length from beak to lower posterior margin 12 mm.

Width at a right angle to this measurement 7.5 mm.

Depth of valve 4 mm.

Holotype.— Personal collection of G. D. Harris.

Horizon.— Horizon of *L. gardneræ*, St. Maurice Eocene.

Locality.— Cooper's Mill, one and one-half miles south of Sabinetown, Texas.

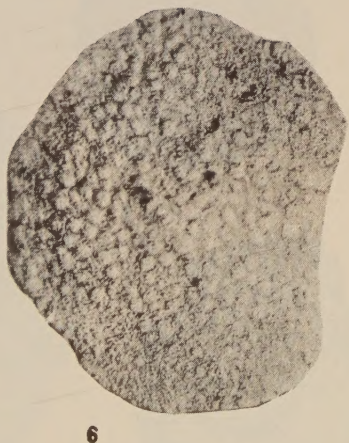
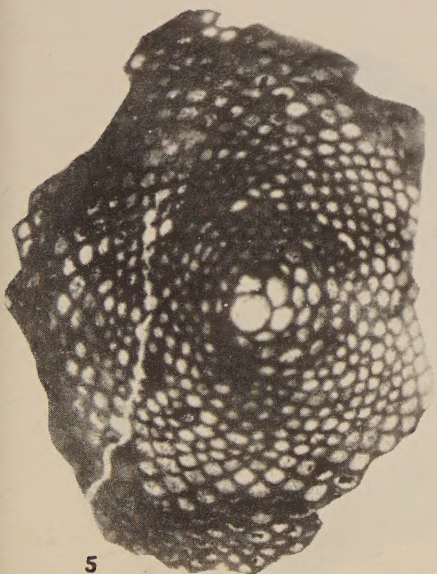
This rather unusual *Mytilus* is named in honor of Prof. G. D. Harris of Cornell University.

EXPLANATION OF PLATES*

EXPLANATION OF PLATE 1

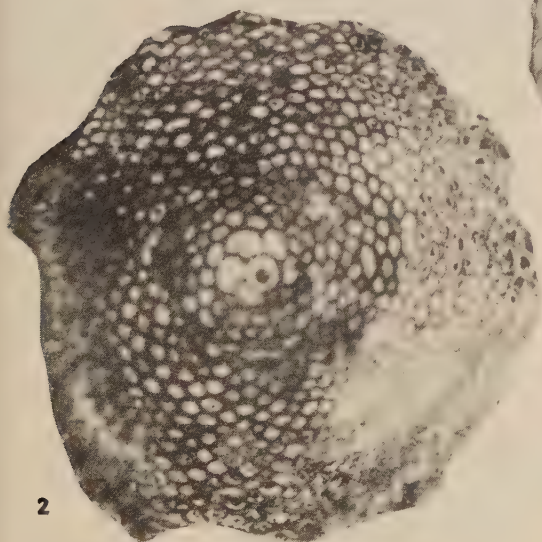
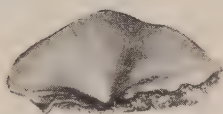
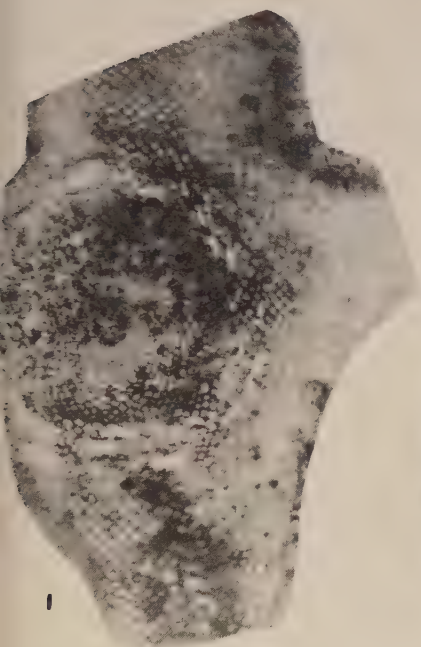
FIG.	PAGE
Lepidocyclina (Polylepidina) gardneræ Cole, n. sp.	Page 4
Cotypes from Cooper's Mill, one and one-half miles south of Sabinetown, Texas.	
1. Vertical section of a microspheric form, showing the irregular and occasional development of the lateral chambers; x 17.	
2. Vertical section of a microspheric form, showing the lack of lateral chambers, but the strong development of pillars; x 10.5.	
3. Vertical section of an extremely lenticular individual; x 10.	
4. Horizontal section of a microspheric form, showing the initial coiling and gradual enlargement in size of the equatorial chambers as they approach the periphery; x 10.5.	
5. Horizontal section of a megalospheric form, showing the development of the embryonic apparatus and equatorial chambers; x 28.	
6. External view, showing relation and size of pustules; x 10.	

*Author and publisher have shared equally in the expense of plates.



EXPLANATION OF PLATE 2

FIG.	PAGE
1. <i>Lepidocyclina</i> (<i>Polylepidina</i>) <i>gardneræ</i> Cole, n. sp.; horizontal section of a microspheric form, showing initial coiling and equatorial chambers; cotype; x 10	4
2. <i>Lepidocyclina</i> (<i>Polylepidina</i>) <i>gardneræ</i> Cole, n. sp.; horizontal section of a megalospheric form, showing the embryonic apparatus; cotype; x28	4
3. <i>Mytilus gilbertharrisi</i> Cole, n. sp.; holotype; x 2.6	6
4. <i>Mytilus gilbertharrisi</i> Cole, n. sp.; holotype; x2.6	6
5. <i>Operculinella sabinensis</i> Cole, n. sp.; side view, showing the sutures; cotype; x10	6
6. <i>Operculinella sabinensis</i> Cole, n. sp.; section showing coils and arrangement of chambers; cotype; x10	6



**BULLETINS
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**CONTRIBUTIONS TO THE TERTIARY PALEONTOLOGY
OF NORTHERN PERU :**

Part 2, Upper Eocene Mollusca and Brachiopoda

By **A. A. OLSSON**

May 24, 1929

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PREFATORY NOTE

The following report, dealing with Eocene Mollusca and Brachiopoda is a continuation of the Contributions to the Tertiary Paleontology of Northern Peru, began in Volume XIV, No. 52, of these Bulletins. The following new genera and subgenera are proposed in this paper.

Boggsia. Type: *Turritella anceps* Woods.

Woodsalia. (Subgenus of *Mesalia*). Type *Turritella negritosensis* Woods

Iddingsia. (Subgenus of *Cerithium*). Type: *Cerithium leviusculum* Gabb

Perucerithium. (Subgenus of *Cerithium*). Type: *Cerithium restinense* n. sp.

Hopkinsiana. (Subgenus of *Rhinoclavis*). Type: *Morgana costata* Woods

Lagunitus. Type: *Telescopium peruvianum* Woods

Harrisianella. Type: *Harrisianella peruviana*, n. sp.

Peruficus. Type: *Peruficus lagunitensis*, n. sp.

Andicula. Type: *Surcula occidentalis* Woods

Gloversville, N. Y.

January 1st, 1929.

DESCRIPTION OF SPECIES

Class PELECYPODA

Order PRIONODESMACEA Dall

Superfamily ARCACEA Deshayes

Family ARCIDÆ Dall

Genus ARCA (Linnæus) Lamarck

Subgenus BARBATIA Gray

Arca (Barbatia) saladoensis, n. sp.

Plate 1, figs. 1-3

Shell small, thin, inequivalve, elongate subrhomboidal and finely sculptured; the outline is elongate subrhomboidal, the hinge and basal margin being nearly parallel with the posterior side but little wider; posterior side straight or slightly irregular, meeting the basal and hinge margins at 90 degree angles; anterior side slightly rounded; the right valve has a sharp, pronounced umbonal ridge bordered on the anterior side by a wide, depressed medial zone or sinus, deepest on the umbo, while the right valve is less flexuous, with a weaker umbonal ridge and medial sinus; hinge line straight with a (probably narrow) cardinal area; sculpture consists of very fine riblets or threads, fairly regular on the umbonal ridge; the interspaces are generally wider, heavy and irregular on the umbonal ridge and posterior submargins; deep, concentric lines marking resting stages cross the surface of the left valve at fairly regular intervals and these are heaviest on the anterior side; the right valve is generally free from resting marks; the shell is thin so that the internal molds show the form of the valves and the fine radial threads; hinge and cardinal area not exposed.

Length 21 mm.; height 10 mm.; semidiameter 5.5 mm.; (left valve)

Length 23.5 mm.; height 12.5 mm.; semidiameter 4.25 mm.; (right valve)

Remarks.— The hinge and cardinal area not being exposed, it is difficult to determine the true relationship of this peculiar species. Its fine sculpture and regularity of form, suggests a *Barbatia*, its strong umbonal ridge, a true Ark. The shell is inequivalve, the umbonal ridge being much higher and sharper on

the left valve, and closely resembling the left or arched valve of the Indian *Parallelepipedum* Klein; while on the right valve, the umbonal ridge is comparatively low and weak. Amongst the *Barbatias*, the species is nearest certain members of the section *Obliquarca* Sacco (type *A. modioliformis* Deshayes), a group well represented in the European Eocene and continuing into the Neogene. In this section, the valves are Modioliform and the umbonal ridge is low and weak.

Locality and Geologic Occurrence.— Restin formation, Que. Salado.

Subgenus DILUVARCA Woodring

Section ARGINA Gray

Arca (*Argina*) *samanensis*, n. sp.

Plate 1, figs. 4, 5

Shell small, ranging from 20 to 25 mm. in length, moderately convex, subovate to subrhomboidal in outlines; valves equal in size and sculpture, with low, prosogyrate beaks but not prominent umbos; umbonal angle rounded above, with a sloping but not strongly depressed or contracted posterior-dorsal submargins; cardinal area very narrow; the ventral margin is usually slightly contracted just anterior of the umbonal slope; the anterior side slightly rounded, the posterior side nearly straight and forming with the ventral side nearly a right angle; sculpture of both valves nearly alike, with about 24 or 25 low, flattened ribs, divided by flat interspaces of the same width as the ribs themselves; there are about 16 ribs, anterior of the rounded umbonal slope.

Length 21 mm.; height 18 mm.; diameter 14.25 mm.

Length 25.5 mm.; height 22 mm.; diameter 16 mm.

Remarks.— This species is commonly associated with *A.* (*Argina*) *sullanensis* Woods in the Upper Saman sandstones of the Chira valley. It differs from the young of that species by its outline which is longer and less circular. The ribs also are fewer in number and the umbos are higher and narrower. The external appearance of *sullanensis* is decidedly *Cardium*-like with strongly convex valves, very numerous ribs (37 or 38) and subcircular outlines.

Locality and Geologic Occurrence.— Saman formation, Casa Saman, Lagunitas, Talara.

Superfamily OSTRACEA Goldfuss
Family OSTREIDÆ Lamarck
Genus OSTREA Linnæus

Ostrea quiroga, n. sp.

Plate 2, figs. 3, 4, 5

Shell medium to large, irregular, higher than long or broadly subovate; surface of both valves smoothish, the lower or attached simply with concentric growth lines; attachment of the left valve often with faint to subobsolete radial costæ or ribs, the upper generally simply with concentric growth lines; attachment of the left valve by the beaks or along the posterior dorsal side, leaving a scar of irregular size; the lower valve is slightly more convex; deeper, irregular and with a high, erect cardinal area carrying a deep, wide ligamental groove; upper or right valve flatter, becoming very massive in large specimens, especially along the posterior dorsal side; cardinal area wide, erect; anterior and posterior submargins of the upper valve feebly dentate.

Remarks.— This species is the common oyster in the *Clavilithes* series, replacing the *O. Buski* Woods of the *Turritella* beds. It often grows to a very large size, forming thick oyster zones in the coastal phase sandstones along the foot of the Amotape Mountains from Que. Mogollon and northward. It may be distinguished from the other Peruvian oysters by its nearly smooth surface, only the left valve sometimes showing faint to subobsolete radial ribs or costæ.

Localities and Geologic Occurrences.— Salina formation, Negritos, La Brea; Pale Greda formation, Negritos; Parinas formation, Negritos; coastal phase sandstones along the foot of the Amotape; Restin formation, Jabonillal, etc.

Ostrea restinensis, s. sp.

Plate 2, figs. 1, 2

Shell of medium size, heavy, inequivalve; lower or attached valve larger, sometimes irregular but typically subelliptical in form (with the height nearly twice the width), convex and deep; upper valve smaller, flattish and usually quite heavy or massive; sculpture of both valve is similiar, consisting of distant and fairly regular, concentric and overlapping shell layers or lamellæ forming broad smooth bands; on an average specimen, these bands measure about 5 mm. in width; hinge of lower valve with a moderately wide and slightly inclined ligament area; in the upper

valve, the hinge area is smaller with the bordering submargins irregularly crenulated.

Height 98 mm.; length 62 mm.; semidiameter 38 mm. (lower valve)

Height 72 mm.; length 46 mm.; semidiameter 35 mm. (lower valve)

Height 79 mm.; length 49 mm.; semidiameter 19 mm. (upper valve)

Height 79 mm.; length 55 mm.; semidiameter 50 mm. (both valves)

Remarks.— A coarse, heavy species distinguished by its smooth, concentric banded sculpture. *Ostrea inca* Woods, very common in the basal Salina formation, has a similiar banded sculpture but that species is much smaller and with a comparatively thin shell. The larger individuals of *Ostrea inca*, rarely exceed 55 mm. in length and usually have a pronounced saddle-like form.

Locality and Geologic Occurrence.— Restin formation, Restin and Cabo Blanco.

Order TELEODESMACEA Dall

Superfamily CARDITACEA Menke

Family CARDITIDÆ Gill

Genus VENERICARDIA Lamarck

Venericardia planicosta, var. *labreaensis*, n. var.

Plate 3, figs. 1, 2

In this form, the shell is small or medium sized, moderately convex or inflated and with 19 or 20, strong, persistant ribs; umbos prominent, with strongly curved, adjacent beaks; lunule cordate, moderate in size and deeply sunken; on the umbos, the ribs are high, narrow and knife-like with deep, wide and flat interspaces; ventrally the ribs become wider and on the medial portion of the valve are broad and flat-topped, with the interspaces remaining deep but only about one-half the width of the ribs themselves; the first five anterior ribs are tri-partite with a central, larger, riblet bordered on each side by a smaller riblet; on the next three or four ribs (8-9), the central riblet increases rapidly in size, becoming wide and flat, while the lateral riblet is very small and threadlike, or simply a low, vanishing terrace; the following five ribs (to 14) lie across the medial portion of the valve to the umbonal ridge; the remaining ribs (to 19 or 20) on the posterior-dorsal submargins are low, narrow with wide interspaces.

Length 36.50 mm.; height 34 mm.; diameter 27 mm.

Remarks.— This variety is the dominant form in the Negritos formation or the Turritella beds of La Brea. It is distinguished from the other members of the *planicosta* group, by its constantly tripartite anterior ribs. It is always a small or medium-sized shell, our largest specimen being about 45 mm. in length.

Locality and Geologic Occurrence.— Negritos formation, La Brea.

Venericardia talara, n. sp.

Plate 3, figs. 4, 5

Shell subcircular, inflated with full, prominent umbos; beaks small, adjacent, curved over the deeply sunken lunule and placed as illustrated quite close to the anterior side; ligamental area showing a deep, but narrowly, lenticular slit along the hinge-margin; general outline of shell is subcircular to nearly square, the height being about equal to the length; sculpture of 24 to 25 narrow, strongly beaded or roughened ribs and deep, groove-like interspaces; the ribs are very narrow and sharp on the posterior-dorsal submargins, generally wider and rougher on the anterior side; umbonal slope feeble, bordered by a depressed or concave zone.

Length 31 mm.; height 31.5 mm.; semidiameter 11 mm. (type, right valve)

Length 42 mm.; height 38 mm. (broken)

Remarks.— This species is related to *Venericardia rotunda* Lea from the Claiborne and Jackson Eocene of the Southern States, the nearest approach being the shell figured by Harris¹ on plate 28, as figure 7. *Rotunda* is usually much smaller, less convex and the post-umbonal area is less deeply impressed. The sculpturing of the narrow ribs of *talara* is more elaborate. This species is known only from the fossil zone at the base of the Restin.

Locality and Geologic Occurrence.— Restin formation, Negritos.

Superfamily LUCINACEA Anton

Family LUCINIDÆ Fleming

Genus LUCINA Lamarck

Lucina corbula, n. sp.

Plate 1, fig. 7

Shell of medium size, thin, orbicular and strongly inflated;

¹Harris, 1919, Bull. Amer. Pal., vol. 6, p. 78, pl. 28, fig. 7.

beaks low, slightly prosogyrate and situated about the anterior one-fourth; the posterior and anterior margins, together with the ventral margin are evenly rounded and form part of the same circle; the posterior-dorsal margin is straight, meeting the posterior side in a broad curve; the anterior dorsal margin is relatively short and descending; the shell is strongly convex or inflated, greatest about the center; surface smoothish or simply sculptured with rough but fairly strong, irregular growth lines; the interior of the shell, judging by the internal mold is more or less roughened or pustulose in the center and umbonal area; the pallial line situated close to the ventral margin is irregular with short radiating lines or furrows crossing it; hinge and lunular characters not visible in our specimen.

Length 34.5 mm.; height 30.5 mm.; semidiameter 9 mm.

Remarks.— In general form, this shell closely resembles the *Lucina corpulenta* Dall from the Chipola Miocene of Florida, the Peruvian species being less equilateral. From rocks of Eocene age, the shell may also be compared with the *Lucina subvexa* Conrad and *Lucina ozarkana* Harris of the Wilcox and St. Maurice beds of the Southern States. From both of these species, the present form differs in its shorter, less produced and rounder anterior side.

Locality and Geologic Occurrence.— Restin formation, Que. Conventos.

Genus PHACOIDES Blainville

Subgenus MILTHA H. and A. Adams

Phacoides (Miltha) conventus, n. sp.

Plate 3, fig. 3

Shell of medium size, suborbiculate, compressed or slightly convex; beaks small and inconspicuous, with scarcely differentiated umbos; ventral and anterior margins of the shell evenly rounded; dorsal and posterior margins nearly straight, meeting to form a right angle; the posterior area is rather wide, and defined in the left valve by a faint fold along the umbonal slope; sculpture consists of fine, fairly regular raised concentric lines or lamellations between wider concentric bands or interspaces; these concentric lamellations continue across the dorsal area to the hinge margins; the interspaces or bands are finely sculptured.

tured with small, raised growth lines or threads; interior concealed.

Length 29 mm.; height 26 mm.; semidiameter 4 mm.

Remarks.— This species is closely related to *P. (Miltha) claibornensis* Conrad from the St. Maurice Eocene of Alabama, Georgia and Virginia. In Dall's² and Harris's³ figures of a right valve, the umbos are shown as more central and with a fairly large lunule, but no such structure is noticeable on our specimen which is a left valve.

Locality and Geologic Occurrence.— Restin formation, Que Conventus.

Family DIPLODONTIDÆ Dall

Genus DIPLODONTA Bronn

Diplodonta caboblanca, n. sp. —

Plate 1, figs. 6, 8

Shell small or medium size, thin, moderately inflated, subcircular to subovate in form; valves inequilateral with small, closely adjacent beaks and wide, full but not prominent umbos; greatest inflation of the valves slightly posterior of the middle, along an evident bulge extending from the umbos to the posterior-dorsal submargins; the posterior-dorsal submargins more or less impressed in a *Lucina*-like fashion but less evident on some shells than others; no lunule; surface simply marked with irregular growth lines; interior concealed.

Length 26 mm.; height 24 mm.; diameter 14 mm.; (Holotype, Cabo Blanco)

Length 32 mm.; height 29 mm.; diameter 17 mm.; Cabo Blanco

Length 23 mm.; height 22 mm.; diameter 14 mm.; Restin

Remarks.— The specimens from the Cabo Blanco sandstones of Parinas age are somewhat larger than those from the Restin, as indicated by the above measurements. The hinge poorly preserved in a few specimens, has a bifid posterior cardinal tooth in the right valve and apparently no laterals. Most of the fossils show a slightly impressed posterior dorsal area but not differentiated as amongst the *Lucinidæ*.

Locality and Geologic Occurrence.— Parinas formation, Cabo Blanco. Restin formation, Restin and Cabo Blanco.

² Dall, W. H., 1903, Trans. Wagner Free Inst., vol. 3, pt. 6, p. 1374, pl. 50, fig. 18.

³ Harris, G. D., 1919, Bull. Amer. Pal., vol. 6, p. 121, pl. 39, figs. 8, 9.

Superfamily CARDIACEA Lamarck

Family CARDIIDÆ Fischer

Genus CARDIUM Linnæus

Subgenus CERASTODERMA Mörch

Cardium (Cerastoderma) himertum, n. sp.

Plate 3, fig. 6

Shell small, plump, slightly inequilateral and oblique; greatest convexity of the valves about the middle, with scarcely differentiated umbos ending in the small, pointed beaks; valves sculptured with 22 or 23, strong, rounded ribs, separated by narrower flattened interspaces; the ribs are of about equal size, except those near the anterior and posterior extremities; the interspaces are nearly smooth, often with an interstitial thread except on the anterior side where they are cross-striated by concentric raised threads; this cross-striation is particularly well-marked on the sides of the interspaces and margins of the ribs, their summits however being smooth; internally, the ribs show as narrow, rounded grooves with wide, flat interspaces; these costal grooves extend well up towards the umbos which are smooth.

Length 20.5 mm.; height 20 mm.; semidiameter 6.5 mm.

Remarks.— This species resembles the *C. panastrum* Dall⁴ of the Oak Grove sands of Florida, but differs as far as can be determined from figures, by its more numerous and narrower ribs. Both species are oblique, which gives to these shells, the external aspect of a small, plump *Venericardia*.

Locality and Geologic Occurrence.— Restin formation, Que. Salado.

Class GASTROPODA

Subclass STREPTONEURA Spengel

Order ASPIDOBANCHIA Schweigger

Suborder RHIPIDOGLOSSA Troschel

Family NERITIDÆ Lamarck

Genus NERITINA Lamarck

Neritina stadnichenkiæ, n. sp.

Plate 4, figs. 7, 8

Shell small to fairly large, transversely-ovate, the form of the

⁴ Dall, W. H., 1900, Trans. Wagner Free Inst., vol. 3, pt. 5, p. 1093, pl. 40, fig. 14.

See also Gardner, J., 1926, Prof. Paper 142-C, U. S. Geol. Survey, p. 137, pl. 23, fig. 5.

shell being depressed and *Velates*-like; spire very small, flattened, lying in the same plane as the upper surface of the body-whorl; last whorl is large, nearly hiding the earlier turns and most of the spire, it is transversely ovate in form, vaulted or convex across the back, strongly flattened above; aperture large, with a slightly flaring and sinuous edge; inner lip with a wide callous platform spreading over most of the ventral surface of the body whorl; colummella not exposed; surface smoothish or simply marked with faint spirals and growth lines.

Length or greater diameter 23.5 mm.; height 18.25 mm.; lesser diameter 11.5 mm. (Holotype)

Remarks.— The Holotype is a small, but nearly perfect specimen with a length of about 24 mm. When full-grown, the shells become much larger, massive and judging from a fragmentary specimen may reach nearly 40 mm. in length. In form, the species closely approaches the well known *Velates Schmiedeli* Chemn., but probably never attains the large size of that shell. Compared with *Velates* of the same size, it is seen that the beaks are constantly terminal and marginal, while even in quite young *Velates*, the beaks are separated from the margins by a rather wide space, mainly due to a great thickening of the ventral face of the body-whorl. This species is named for Miss Maria Stadnik Stadnichenko, Micro-Paleontologist at Negritos.

Locality and Geologic Occurrence.— Restin formation, Que. Salado.

Order CTENOBRANCHIATA Schweigger

Superfamily GYMNOGLOSSA Gray

Family PSEUDOMELANIIDÆ Fischer

Genus BOGGSIA, n. gen.

Type.- *Turritella anceps* Woods

Turritella anceps Woods, 1922, in Bosworth's Geology of North West Peru, p. 81, pl. 8, figs. 12, 13, pl. 9, figs. 1, 2.

The following is a description of the genus *Boggsia*.

Shell melanoid to sub-turritelloid, subulate, with numerous, convex to subangulated whorls; sutures distinct, strongly oblique or descending; early whorls smooth or finely sculptured with revolving spirals; later whorls smooth; growth lines oblique but not sinuous; aperture subovate, *Littorina*-like in shape and with a thin outer lip.

Remarks.— Among the more characteristic fossils of the Middle Eocene or Clavilithes series, are two melanoid gastropods described by Woods as *Turritella anceps* and *annectans*. In referring these species to the *Turritellidæ*, Woods relied principally on the features of the early whorls which are rounded or convex in form and often sculptured with strong spirals. With growth the whorls may become angulated (*annectans*), or remain simply rounded (*anceps*), the sutures strongly descending and the spirals obsolete or absent so that the surface of the adult shell is smooth or nearly so. The growth lines are oblique to the vertical axis of the shell, but not sinuous as in true *Turritella* and *Mesalia*. The shape of the aperture is subovate and *Littorina*-like.

The angulation of the whorl is a variable character, reaching its maximum in half-grown shells of *annectans*. With continued growth, this angulation generally disappears and the profile of the whorl becomes rounded or even convex. In *anceps*, the angulation is very feeble, the form is more elongate and the shell resembles an overgrown *Melanella* (*Eulima*).

When full-grown, both *anceps* and *annectans* have a decided *Melania*-like aspect and I am inclined to regard them as members of Fischer's *Pseudomelaniidæ*, but apparently distinct from any of the known generic forms. In shape, *Boggsia* approaches the more elongate species of *Pseudomelania* and *Bayania*, but differs by its strongly oblique aperture. With the fresh-water *Melania*s, *Boggsia*, according to Cossmann's classification and description, would fall near the section *Stenomelania* Fischer, but differs both in its marine habit and non-sinuated outer lip.

This new genus is named for Mr. O. D. Boggs, resident geologist at Negritos.

Superfamily TÆNIOGLOSSA Bouvier

Family TURRITELLIDÆ Gray

Genus MESALIA Gray

Subgenus WOODSALIA, n. subgenus

Type.— *Turritella negritosensis* Woods

Plate 4, figs. 5, 6

The following is a description of the subgenus *Woodsalia*.

Shell short, stubby and solid; whorls comparatively few, rapidly enlarging so that the taper of the spire is rapid and *Mesalia*-like; whorls convex, often with a strong peripheral carina or with one or more strong, spiral cords; base of last whorl rounded or convex, not flattened as in *Turritella*; growth lines sinuated, *Mesalia*-like, but the basal lobe projecting but little beyond or in front of the upper or sutural lobe; aperture rounded, with a shallow anterior sinus; inner lip thickened, its edge free so that the peristome is continuous and entire; a strong, oblique, parietal fold often present.

Remarks.— Woods considered *negritosensis* as a true *Turritella*, allied to *T. mortoni* Conrad, a Wilcox species of the southern United States, belonging to Montfort's subgenus *Haustator*. From most species of *Turritella*, *negritosensis* differs by its shorter, stubbier form, less numerous whorls but principally by its continuous peristome and shallow anterior sinus. In most of these characters, *negritosensis* is obviously more closely related to *Mesalia* than to the true *Turritellas*.

In full-grown individuals, the last whorl appears to be slightly smaller and contracted. The outer lip has a wide, medial sinus and a convex fold at its anterior portion. *Mesalia* has a similar sinus but the lower or anterior fold projects much further forward than in this species. There is a shallow, *Mesalia*-like anterior canal at the tip of the pillar or columella. The inner lip is thickened or callused, its edge free so that the peristome is entire and continuous in mature specimens. A strong parietal fold may be present but this feature is not constant and does not appear in many specimens.

In *Turritella lissoni* Woods, the aperture is less commonly preserved but judging from fragmentary specimens, it appears to agree with *negritosensis* in essential characters. The species frequently has a strong basal cord which lies submerged in the sutures of the earlier turns. The *Turritella* (?) *robusta* Gabb from the Cretaceous "Chico Groups" of California, judging by Stewart's⁵ figure, resembles *negritosensis* by its short, stubby whorls, sculpture and large apical angle. It may belong to this

⁵ Stewart, 1926, Proc. Acad. Nat. Sci. Phila., vol. 78, p. 353, pl. 21, fig. 4.

subgenus.

Locality and Occurrence.— Negritos formation, Negritos and La Brea.

Family CERITHIIDÆ Menke

Superfamily CERITHINÆ H. and A. Adams

Genus CERITHIUM Bruguiere

Subgenus IDDINGSIA, n. subgenus

Type.— *Cerithium læviusculum* Gabb

Plate 4, figs. 1, 4

Cerithium læviusculum Gabb, 1869, Amer. Journ. Conch., vol. 5, p. 27., 1877, Journ. Acad. Nat. Sci. Phila., vol. 8, p. 264, pl. 35, fig. 4.

Cerithium paytense Woods, 1922, p. 87, pl. 10, figs. 7-9.

Faunus paytense Hanna and Israelsky, 1925, Proc. Calif. Acad. of Sci., 4th series, vol. 14, p. 42, pl. 8, fig. 8.

The following is a description of the subgenus *Iddingsia*.

Shell large or medium size, elongate, smooth except the nepionic whorls which have a cancellate sculpture of both ribs and spirals; immature shells have a flattened base with strong, spiral grooves and cords; when full-grown, the base is rounded, smooth or with irregular spiral bands; outer lip thin, moderately expanded in front, with a wide, shallow posterior sinus a short distance below the suture; anterior canal short, erect, deep and slightly re-curved; growth lines sinuous, parallel to the contour of the outer lip, on the spire whorls showing a wide, concave sinus between the sutures; heavy, rib-like resting marks developed on the ventral surface of the body whorl of large individuals; inner lip callused, no columellar or parietal plaits.

Remarks.— *Cerithium læviusculum*, the type of this new subgenus, was described by Gabb from specimens collected by Professor Orton from the Saman sandstones of Paita. Later the same species was redescribed by Woods from the same locality as *Cerithium paytense*. Owing to the strong callosity of the inner lip, Hanna and Israelsky removed the species from *Cerithium* and referred it to *Faunus*, but the discovery of more perfect specimens definitely show, that this species should be retained in the family *Cerithiidæ*.

Iddingsia bears much resemblance in form and in its smooth

whorls to *Gymnocerithium* Cossman of the European Portlandian, but differs in possessing a typical cerithioid anterior canal and the outer lip is sinuous and not straight. Specimens with perfect outer lip and anterior canal are very rare, and the above diagnosis is partly based on a well preserved specimen of var. *saladoensis* from the Upper Restin. The nepionic whorls have a cancellated sculpture of ribs and spirals, this sculpture generally persisting somewhat longer on typical *læviusculum* of the Upper Saman, than in the shells from the older beds. The succeeding whorls are smooth, flat-sided or slightly convex between close, distinct, linear sutures. Immature shells have a flattened base and a more or less angulated periphery, the base becoming well rounded when adult. Due to the slightly expanded outer lip, resting marks may be developed at intervals on certain large, gerontic individuals.

This new subgenus is quite abundant and characteristic of the Peruvian Upper Eocene but rare or lacking in the Oligocene. Its earliest appearance is in the Upper Restin, of La Breita and Que. Salado as variety *saladoensis*, where it occurs associated with *Corubla* (*Cuspicorbula*) *busera* and *Anomia septenaria*.

This new subgenus is named for Mr. Arthur Iddings, Assistant Manager at Negritos and formerly in charge of the Geologic Office.

***Cerithium læviusculum*, var. *saladoense*, n. var.**

Plate 4, figs. 2, 3

This variety differs principally from typical *læviusculum* in its more accelerated development. It is usually a smaller shell, the whorls slightly more convex, sometimes appearing coronate or feebly shouldering about the upper suture, and the base of the whorl is more rounded in immature shells and with stronger, persistent sculpturing. In a similar degree, the cancellated sculpture of the early whorls is of shorter duration and confined to fewer whorls.

Locality and Geologic Occurrence.— Restin formation, Que. Salado, La Breita.

Subgenus PERUCERITHIUM, n. subg.

Type.- *Cerithium* (*Perucerithium*) *restinense*, n. sp.

The following is a description of the subgenus *Perucerithium*:

Shell large, heavy, solid; whorls numerous between close, linear or deeply channelled sutures; surface smooth, or with heavy longitudinal ribs or folds, the base flattened or convex, and generally with spiral sculpture; outer lip thin, sinuous, slightly expanded about the basal portion; there is a wide, shallow, posterior sinus, its axis about the middle of the whorls and midway between the sutures; anterior canal short, apparently with a typical, recurved cerithial canal; growth-lines sinuous, following the contour of the outer lip.

Remarks.— The older Peruvian Eocene is characterized by several large cerithioid fossils such as *Pseudoglauconia lissoni* Douvillé and several species, belonging to this new subgenus. To *Perucerithium* belong besides the type species *restinense*, the "*Cerithium*" *negritosense* Woods, *hopkinsi*, *xenium* and *iddingsi* Olsson.

In most cases, the outer lip being very thin and fragile, has been destroyed during fossilization. When preserved, it is seen to be feebly expanded about the anterior portion and with a wide, shallow posterior sinus. The growth lines closely parallel the contours of the lip, and show a wide sinus midway between the sutures, a forward fold across the base and a small sinus about the end of the cerithial anterior canal. In *Pseudoglauconia*, the growth lines are similar but also have a deep, *Glauconia*-like sinus about the center of the base.

The large cerithioids of the European Eocene superficially resemble *Perucerithium*, but differ in several, important respects. In *Campanile*, the outer lip is broadly expanded and the columella provided with one or more heavy folds. *Bellardia* is somewhat closer, but has a different shaped aperture, the outer lip being strongly recurrent at the suture besides possessing parietal plaits and strong, knobs or humps on the dorsal side of the penultimate whorl.

Cerithium (Perucerithium) restinense, n. sp. Plate 5, figs. 1, 2, 3, 4, 7

Shell rather large, solid, subelongate; whorls numerous, the earlier ones straight or slightly convex in profile, the later coronated or developing a sharp, reflexed edge about the upper suture; sutures at first simple, becoming canaliculate on the lower half of the shell; general surface of the shell is smooth, except for spirals on the base of the last whorl and broad low ribs of variable character on the upper turns; these ribs number 6 or 7, are narrow, straight or a little oblique, more or less in line across the sutures, and separated by wide, shallow interspaces; the ribs are generally absent from the last and penultimate whorls or even earlier; base rounded or subcontracted, with coarse, spiral cords; growth-lines sinuous, with a wide, shallow sinus midway between the sutures and a slight forward basal fold; outer lip thin, somewhat expanded, a weak posterior sinus or inflexion across the upper one-quarter and a broad, convex basal fold; anterior canal, cerithioid, short and recurved.

Length 70 mm. (2 whorls); greater diameter 56 mm.

Length 88 mm. (4½ whorls); greater diameter 40 mm.

Locality and Geologic Occurrence.— Parinas formation, Cabo Blanco sandstones near Restin.

Genus RHINOCLAVIS Swainson

Subgenus HOPKINSIANA, n. subg.

Type.— *Morgana costata* Woods

Plate 6, figs. 8, 10, 11

The following is a description of the subgenus *Hopkinsiana*.

Shell small or medium size, cerithioid to pupoid in form; whorls flat or slightly convex, often weakly coronated about the upper suture; protoconch unknown; early nepionic whorls cancellated or sculptured with both ribs and spirals, later whorls with strong spiral bands or simply smooth; base sloping; aperture like *Rhinoclavis* but with a sinuated outer lip; anterior canal cerithioid, strongly oblique and recurved; apparently no parietal or columellar plaits; outer lip thin with a broad shallow sinus.

Remarks.— Woods referred his *costata*⁶ and *magma*⁷ to the

⁶ Woods, H., 1922, in Bosworth's Geology of North-West Peru, p. 82.

⁷ *Ibid.* p. 83.

Indian and Persian genus *Morgana* Cossmann of the *Melanopsidæ*. The smaller *costata* is without much doubt, a cerithioid, perfect specimens having a typical cerithioid siphonal canal and a quite typical *Cerithium* aperture. The anterior canal is strongly oblique with a relatively short columellar pillar as in *Rhinoclavis*, which the fossils also resemble in form. They differ mainly from *Rhinoclavis* by their sinuated outer lip and absence of columellar and parietal plaits. Typical *Rhinoclavis* does not appear to be known as fossil, the Tertiary species of Europe, being referred by Cossmann to the subgenera *Pseudovertagus* Vignal and *Semivertagus* Cossmann. *Hopkinsiana* is closest to *Semivertagus* in lacking both parietal and columellar plaits but is distinguished by its sinuated lip.

Subfamily POTAMIDINÆ H. and A. Adams

Genus LAGUNITUS, n. gen.

Type.— *Telescopium peruvianum* Woods

Telescopium peruvianum Woods, 1922, in Bosworth's Geology of North-West Peru, p. 91, pl. 11, figs. 13, 14.

The following is a description of the genus *Lagunitus*.

Shell conic to broadly turritelloid, consisting of numerous, narrow whorls between close, linear sutures; whorls flattened, sculptured with numerous, straight or concave folds, generally crossing from suture to suture, but not extending below the peripheral groove onto the base; the periphery of the base is angular, with a deep furrow lying between two spiral cords emerging from the suture; base flattened, generally covered by callus deposit spreading from the inner lip; the growth lines have a strong forward curve on the flattened base and a weak or shallow sinus across the main face of the whorl, midway between the sutures; perfect aperture not known, but from fragmentary specimens the outer lip appears to have been more or less expanded; inner lip heavily callused at its posterior side or junction with the outer lip, spreading upward across the face of the next whorl to and sometimes beyond the upper suture; outer lip not known; a short, stout, twisted columellar pillar and anterior canal.

Remarks.— Two species of this peculiar and interesting group

are known from the Upper Saman rocks of Peru. They are quite common in some localities (*Lagunitas*), but since they occur principally in coarse, gritty sandstones, the shells are invariably broken and no specimen with a complete aperture has been found. The flattening of the base is accentuated by the breaking and loss of the later whorls.

Lagunitus is clearly a member of the *Potamidinæ*, and *peruvianum*, the most abundant species, was provisionally referred to the genus *Telescopium* by Woods. *Lagunitus* differs from *Telescopium* represented in the Peruvian Eocene by a typical species in the Parinas sandstones, by its larger shell with a dominantly axial and not spiral sculpture, and by its heavily callused inner lip. Details of the outer lip, columellar and anterior canal are not sufficiently well-known for comparison.

The two known species of this genus, *peruvianum* Woods and *samanense* Olsson appear to be limited to the Upper Eocene or Saman formation.

Genus HARRISIANELLA, n. gen.

Type.- *Harrisianella peruviana*, n. sp.

Shell turritelloid, with a gradual tapering spire and suture bordered by a *Terebra*-like fasciole; base of last whorl flattened, angled and bordered by a peripheral cord between 2, deep spiral grooves; sculpture of closely spaced, curved riblets which begin abruptly at the peripheral cord and extend to the upper suture; base with only revolving cords; aperture rounded, the outer lip sinuous, with a broad medial sinus and a forward convex curve across the basal portion; peristome probably entire, the beak or pillar with an encircling fold.

Remarks.— Because of their strong, sutural fasciole and axial sculpture, these shells bear a striking but superficial resemblance to the *Terebras*, and a species evidently belonging to this genus, was described by Heilprin⁸, as *Terebra plicifera* from the Texas Eocene. The peristome is entire, the outer lip with a wide, medial sinus and a convex fold or bulge across the basal portion. The

⁸ Heilprin, 1880, Proc. U. S. Nat. Mus., p. 151, pl., fig. 8., also Aldrich, 1897, Bull. Amer. Pal., vol. 2, No. 8, p. 170, pl. 3, fig. 2a.

base of the aperture being destroyed, the absence or presence of a shallow canal cannot be determined.

The genus *Aurelianella* Cossmann⁹, the type which is *A. mutabilis* Cossmann from the Parisien Eocene, resembles *Harrisianella* in form and sculpture, but is a smaller shell, the outer lip is not sinuous, and the axial sculpture is lacking from the later whorls.

Harrisianella probably belongs to the *Potamidinae*. It is named for Professor G. D. Harris, of the Paleontological Department of Cornell University.

***Harrisianella peruviana*, n. sp.**

Plate 8, fig. 7

Shell of medium size, turritelloid, with numerous, slowly tapering whorls; sutures indistinct, lying in a deep groove and carrying a small, central cord; whorls flat or straight sided and sculptured in a *Terebra*-like fashion with a strong sutural fasciole and axial ribs, the upper ends of which are disjointed by the fasciole groove; below the fasciole, the surface has about 24, straight to slightly curved, strong riblets, which end, either at the lower suture or very abruptly at a spiral cord, between two grooves encircling the periphery of the body whorl or the upper edge of the base; base is flattened or slightly excavated and carrying 4 or 5, subobsolete, spiral cords; aperture rounded, the peristome probably entire.

Length 25.5 mm. (6 whorls); diameter 9.5 mm.

Locality and Geologic Occurrence.— Restin formation, Que. Salado, Saman formation, Caleta Sal.

Family CERITHIOPSIDÆ H. and A. Adams

Genus CERITHIOPSIS Forbes and Hanley

***Cerithiopsis quemada*, n. sp.**

Plate 6, fig. 9

Shell small, slender, with numerous whorls and sculpture of spiral cords and fainter ribs; protoconch unknown; spire whorls preserved nearly 5, flattened between distinct sutures; base of last whorl slightly sloping, convex, but not contracted; sculpture of early whorls consists of 4 spiral cords, nodulated by narrow,

⁹ Cossmann, 1893, Catal. ill. coq. foss. Eoc. env. Paris, App. 1, p. 10, fig. 10., also Cossmann and Pissarro, Leon. complete des coq. foss. de l'Eocene env. Paris, tome 2, pl. 26, figs. 139, bis-1.

straight riblets, separated by narrow, deep intervals; the riblets are straight, pass from suture to suture, and weakly across the spiral intervals; in addition, there is a faint cord showing in the suture; on the last whorl, the spirals increase to about 11, only the upper 4 (the 5th slightly) being nodulated by the riblets, the others covering the base being nearly smooth; there are about 27 riblets on the last whorl, but they are much weaker than those of the earlier turns; columella straight; outer lip broken.

Length 9 mm.; diameter 3 mm.

Remarks.— This species is referred with much doubt to the genus *Cerithiopsis*. It differs from most species of that genus, by the larger size and less contracted base. In all our specimens, the aperture is broken and the early spire whorls are lost.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

Family DIASTOMIDÆ Cossmann

Genus DIASTOMA Deshayes

Diastoma geositta, n. sp.

Plate 6, figs. 1, 2

Shell cerithioid, stout, rugose; spire long, nearly twice the length of the aperture and composed of 7, 8 or more flat-sided whorls; protoconch unknown, sutures grooved and with a central, spiral cord; sculpture subcancellate, with strong, regular ribs and spirals; the ribs numbering about 12 on the penultimate and 13 on the last whorl, are strong, regular, longitudinal folds and divided by interspaces of the same width as the ribs themselves; on the spire-whorls, the ribs extend from suture to suture and are nearly in line; on the body-whorl they end abruptly at the periphery; spirals are heavy, regular cords and number about 5 (not including the sutural cord) on the spire-whorls and above the periphery of the body-whorl; base sculptured with numerous, irregular spiral cords, base flattened, sloping; aperture broadly elliptical, the inner lip strongly callused, the columella excavated; outer lip broken.

Height 39 mm.; diameter 17 mm.; aperture 14 mm.

Remarks.— This and the next two species are tentatively referred to the genus *Diastoma*, principally on their sculpture pat-

tern and may require change as more perfect material is discovered. In true *Diastoma*, the peristome is continuous without a true cerithioid anterior canal, while in these shells, the aperture although broken, appears cerithioid, with a fairly long, excavated columella, resembling the incomplete apertures of certain *Ptychocerithium*.

Locality and Geologic Occurrence.— Parinas formation, Keswick Hills.

***Diastoma furnaria*, n. sp.**

Plate 6, fig. 3

Shell similar to the preceding species in form but with a finer sculpture; sutures grooved or slightly excavated; whorls flat-sided, feebly contracted about the middle of the body whorl and more or less coronated below the upper suture; last whorl angulated about the middle with a sloping base, ending in a nearly straight, anterior canal; early spire whorls unknown; sculpture of a feeble series of axial ribs or folds (which probably were continuous from suture to suture on the earlier spire whorls) about the upper suture, extending in a subobsolete manner to the periphery of the last whorl; the main sculpture consists of fine, subregular, spiral bands which cover the whole surface from the upper suture to the tip of the anterior canal; aperture subelliptical to subtriangular, the inner lip slightly callused and angulated at its anterior and posterior ends; columella excavated; outer lip broken.

Length 33 mm. (2 whorls); diameter 18 mm; aperture 19 mm.

Remarks.— Differs from *geositta* by its plainer sculpture, the ribs at maturity being confined to a low, coronated band in front of the upper suture.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

***Diastoma elænia*, n. sp.**

Plate 6, figs. 4, 5, 6, 7

Shell small, with strongly coronated whorls and a sculpture of ribs and spiral bands; spire long, nearly twice the length of the aperture and composed of 5+ whorls; protoconch unknown, the first 4 or 5 post-nuclear whorls are straight or slightly convex in profile and ornamented with numerous, straight riblets, crossed

by 5 or 6, revolving bands between distinct, incised lines; these spiral bands are nearly equal in size, except the uppermost which is constantly a little heavier and on the succeeding turns contributes to the formation of a coronated zone about the upper edge of the whorl; later turns strongly coronated, the penultimate and body whorl with about 10, straight, strong ribs between wider interspaces; the ribs end abruptly at a strong, peripheral cord which is immersed in the sutures of the earlier whorls, the upper ends of the ribs are strongly knobbed in some specimens; whole surface overrun by spiral bands, which are wider on the upper half of the whorl, finer and more crowded on the base; aperture elliptical to subtriangular; inner lip callused, the columellar area excavated; outer lip broken.

Height 20 mm.; (broken); diameter 9.5 mm.; aperture 9.5 mm.

Remarks.— This is a small species and may possibly be only a variety of *furnaria*. Our specimens are evidently mature and show a marked change in sculpture from their nepionic to adult whorls.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

Family STROMBIDÆ d'Orbigny

Genus STROMBUS Linnaeus

Strombus burhinus, n. sp.

Plate 5, figs. 5, 6

Shell of moderate size, biconic, with a fairly high spire and a long, narrow aperture more than one-half the length of the shell; whorls 3 (tip broken) between deep and slightly excavated sutures; spire whorls slightly concave or contracted about the middle between two, faint revolving ridges; body whorl large, at first faintly angulated about the middle by the lower ridge, later becoming sharply shouldered by the upper ridge; on still larger specimens, the shoulder becomes even more prominent and sometimes nodose, while the lower ridge becomes simply a cord or disappears; base of last whorl straight and Cone-like; aperture narrow, linear, the outer lip in all our specimens being thin and straight, paralleled by the growth lines; inner lip slightly callused.

Length or height 54 mm.; (broken); diameter 30 mm.; aperture 40 mm.
Length or height 59 mm.; (estimated)

Remarks.— The generic affinities of this species with the *Strombidae* is uncertain. In form, the shell resembles an immature *Strombus*, this appearance being further accentuated by the development of a strongly angled shoulder which becomes even nodose on old individuals. In other features the species approaches *Clavilithes*, but the base is not contracted, being straight and Cone-like. The outer lip is thin and straight in all our specimens and appears to be mature.

Locality and Geologic Occurrence.— Restin formation, Basal Restin of Negritos, Pozo valley. Restin and Cabo Blanco.

Superfamily RACHIGLOSSA Gray

Family FASCIOLARIIDÆ Chenu

Genus PERUFICUS, n. gen.

Type.— *Peruficus lagunitensis*, n. sp.

The following is a description of the genus *Peruficus*.

Shell pyriform with an inflated body whorl and a low to moderately elevated spire; base of body whorl usually contracted and with a long, straight fusoid anterior canal; surface sculpture reticulate, persistent and heaviest on the spire whorls; columella with two (or possibly three) strong, sharp plaits.

Remarks.— This name is proposed for a group of two or three species, resembling *Ficus* in form and sculpture, the *Fusidae* in their thin, inflated body whorl and straight anterior canal and the *Turbinellidae* in possessing true columellar plaits. The group is probably related to *Strepsidura* Swainson and to *Glyptostyla* Dall, the type of which last, is a Miocene species from Panama, but both these genera differ by their curved or twisted anterior canal. The Eocene genus *Mazzalina* of Conrad, is pyruliform, with a comparatively long but twisted anterior canal and the columellar provided simply with auxiliary folds, there being several (5 or 6 in *inaurata* Conrad) very weak, oblique plaits. *Whitneya* Gabb, according to Stewart¹⁰, is a synonym of *Strepsidura*.

¹⁰Stewart, R. B., Gabb's California Fossil Type Gastropods, Proc. Acad. Nat. Sci. Phila., vol. 78, p. 404.

***Peruficus lagunitensis*, n. sp.**

Plate 8, fig. 11

Shell small, pyriform, coarsely sculptured with revolving spirals and straight, nearly equal riblets; body whorl large, inflated, with a low, elevated spire about one-fifth the total length of the shell; whorls about 4, with appressed, indistinct sutures; body whorl large, convex and deeply contracted about the base, a coarsely reticulate sculpture of strong, revolving, spiral cords and straight, nearly equal riblets; sutures bordered on the lower side by two, closely adjacent cords and these in turn by a depressed or concave zone; the spirals usually consist of two kinds, a primary set of heavy cords, with a finer, secondary spiral in each interspace; the riblets are straight, about equal to the spirals in strength, which they cross and nodulate, the resulting sculpture being coarsely reticulate and *Pyrula*-like; former resting stages indicated by somewhat heavier, longitudinal ridges, roughly spaced 120 degrees apart; aperture broadly semi-lunar, narrowly produced in the region of the anterior canal; anterior canal long, straight and narrowed in a *Fusus*-like manner; columella with 2 (possibly 3) folds.

Height 21 mm.; diameter 14.5 mm.; aperture 17 mm.

Locality and Geologic Occurrence.— Saman formation, Lagunitas.

Family FUSIDÆ Tryon**Genus LEVIFUSUS Conrad*****Levifusus mallacus*, n. sp.**

Plate 7, figs. 1, 2

Shell of medium size, *Fulgur*-like in form and sculpture; whorls 4 or more, widely shouldered above, the shoulder angle bearing 6, strong, heavy spines or tubercles, rest of the surface is smooth except for growth lines and fine, alternating spirals on the anterior canal; growth lines straight except as they cross the shoulder angle when they may be drawn into the spines; aperture broadly ovate but narrowed or produced in front; anterior canal moderately long, strongly bent or twisted near the tip; outer lip thin, the inner lip more or less callused along the face of the body-whorl.

Height 63 mm.; diameter 49 mm.; (Que. Salado)

Height 42 mm.; (broken); diameter 35 mm.; (Lagunitas)

Remarks. — This species is provisionally referred to *Levifusus* Conrad, principally from its resemblance to *Levifusus branneri* Harris of the Jackson Eocene of Mississippi and Texas. The Peruvian fossil is still more *Fulgur*-like and the base is entirely smooth, lacking the encircling spiral which in true *Levifusus* emerges from the suture of the upper side of the aperture. With the East Coast *Fulgurs*, the resemblance is also quite striking, especially to the more spinous species as *Fulgur echinatum* Dall of the Caloosahatchie Pliocene, but the anterior canal appears to be shorter and more twisted.

Locality and Geologic Occurrence. — Restin formation, Que. Salado; Saman formation, Lagunitas (Saman conglomerate).

Superfamily TOXOGLOSSA Troschel

Family CANCELLARIID/E Adams

Genus ADMETE Kroyer

Subgenus ADMETE Kroyer

Section BONELLITIA Jousseaume

Admete (Bonellitia) luffa, n. sp.

Plate 8, figs. 3, 4

Shell small, delicate, with a fairly high spire and coarsely reticulate sculpture; protoconch of about 3, smooth, convex whorls, $3\frac{1}{2}$ to 4, strongly convex and distinctly shouldered about the upper suture; last whorl large with a sloping but not contracted base; sculpture is reticulate and composed of nearly equal spiral cords and narrow ribs; the nepionic whorls generally have 5 spirals (and a few smaller spirals close to the suture) between wide, flat interspaces; on the last whorl, the spirals increase to 13 to 15 and extend from the upper suture, across the surface to the tip of the anterior canal; the ribs are numerous, narrow, straight to slightly oblique on the spire whorls, distinctly oblique across the face of the last whorl; the ribs number about 18 on the last turns; aperture sub-trigonal, interior generally concealed; columella with at least two, strong folds.

Height 14 mm.; diameter; 8 mm.

Height 10.5 mm.; diameter 7 mm.

Remarks.— Faint traces of varices may be seen on some specimens but this feature may be due to crushing. The aperture is filled and incomplete in our specimens, so that the characters of the inner lip and columellar folds are not known. In form, this species resembles *Cancellaria graciloides* Aldrich from the Wilcox of Alabama, but spire is somewhat shorter.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

Family TURRIDÆ Adams

Genus ANDICULA, n. gen.

Type.— *Surcula occidentalis* Woods

Plate 7, figs. 3, 4

Surcula occidentalis Woods, 1922, p. 106, pl. 16 figs. 7-10.

The following is a description of the genus *Andicula*.

Shell fusiform to pyriform with a high conic spire and a long, curved anterior canal; last whorl large, with a pronounced shoulder keel bearing strong, closely crowded spines or tubercles; surface smooth; anal sinus wide, deep and situated on the shoulder keel as in *Turris*.

Remarks.— Two species of large *Surcula*-like gastropods were described by Woods from the Peruvian Eocene as *Surcula occidentalis* and *thompsoni* and a third species was doubtfully referred to the same group by Hanna and Israelsky¹¹ from the Peruvian Oligocene as "*Surcula mayi*". Similiar species combining pleurotomoid and fusoid characteristics are known, principally from the older Tertiaries of Europe, Africa, North and South America. The relationship of most of these forms is very perplexing and they have been described or classified among the *Turridæ* (*Pleurotomidæ*) and the *Fusidæ*. Their resemblance to the *Turridæ* is principally found in their sinuated lip and growth lines, often developing a typical anal sinus. This sinus is usually *Surcula*-like, that is, lying in a sutural fasciole, more rarely as in *occidentalis*, it is *Turris*-like or situated on the shoulder angle. On the other hand, their approach to the *Fusidæ*

¹¹Hanna and Israelsky 1925, Contribution to the Tertiary Paleontology of Peru, Proc. Calif. Acad. of Sci., 4th series, vol. 14, No. 2.

is seen in their generally large sized heavy shell, fusoid to fulguroid form and strong shoulder armed with spines and tubercles.

Certain Eocene species from the southern United States (*Pleurotoma pagodiformis* Heilprin¹² and *Levifusus indentus* Harris¹³) have generally been referred to *Levifusus* Conrad of the *Fusidæ* and Cossmann¹⁴ following this lead, referred to the same genus, the *Fusus Morcki* von Koenen from the Paleocene of Denmark. Other species from the Belgium Eocene to which E. Vincent had proposed a new genus *Surpulofusus* (type *bruxellensis* E. Vin.) are also united by Cossmann with *Levifusus*.

The African forms of which there are two or three species (*Pleurotoma ingens* Mayer-Eymar¹⁷, *Pleurotoma togoensis* Oppenheim¹⁸ and *Clinuropsis diderrichi* E. Vincent¹⁹) are large, fulguroid shells with deep, *Surcula*-like anal sinus and a strongly armed shoulder. *Ingens* was referred to *Pleurotoma* by Mayer-Eymar and Oppenheim, and to *Surcula* by R. Bullen Newton. *Clinuropsis diderrichi* from the older Eocene of the Belgian Congo, is very similiar to *ingens*, but according to R. Bullen Newton²⁰ differs by its more depressed and less excavated whorls, and the peripheral tubercles are nearer the suture. While describing *diderrichi*, E. Vincent also proposed a new genus *Clinuropsis* with *Pleurotoma ampla* Briart et Cornet as type. This genus which he regarded as belonging to the *Fusidæ* he characterized as follows:—"Coquille fusiform, à spire étagée, plus courte que l'ouverture; tours dentés; suture profonde, canal moyennement allongé, très nettement infléchi à dorite; labre très sinueux, découpé sur la rampe en un sinus large; columella lisse. Type:

¹²Heilprin 1880, Proc. U. S. Nat. Mus., p. 149, pl. 4, fig. 1., also Harris 1889, Bull. Amer. Pal., vol. 3, No. 11, p. 51, pl. 6, fig. 10.

¹³Harris, 1899, *op. cit.*, p. 52, pl. 7, fig. 1.

¹⁴Cossmann, 1901, Paleocene, comp., vol. 4, p. 14.

¹⁷Mayer-Eymar, 1895, Journ. de Conch., vol. 43, pp. 50, 51, pl. 4, fig. 1, also Oppenheim 1906, Palaeontographica, vol. 30, pt. 3, pp. 332, 333, pl. 24, fig. 26., also R. Bullen Newton 1922, Eocene Mollusca from Nigeria Bull. No. 3, p. 20, pl. 2, figs. 3-5.

¹⁸Oppenheim, 1915, Beitr. Geol. Erf. Deutsch. Schutzgeb., pt. 12, pl. 5, fig. 5, p. 59.

¹⁹Vincent, 1913, Contr. à la Paleontologie des Falaises de Landana, Annales du Musée du Congo Belge, Ser. 3, Vol. 1, p. 21, pl. 2, figs. 8, 9, 10, 11.

²⁰Newton, R. Bullen, 1922, *op. cit.*, under 5, p. 21.

Pleurotoma ampla Briart et Cornet."

Vincent further pointed out the close resemblance of *Clinuropsis diderrichi* to White's²¹ figure of *Fusus* (*Serrifusus*) from eastern Brazil. White's figure 1, is a cross section of a large fulguroid form with a sharp shoulder armed with stout spines and a slight curved anterior canal. Another South American species is *Pleurotoma acutinoda* Philippi²² of Lebu Chila, a slender form probably related to *thompsoni*.

On close study, the two Peruvian species, *thompsoni* and *occidentalis* appear to belong to different groups. In *thompsoni*, the form is slender, fusoid, the anal sinus is normally *Surcula*-like, although in some cases lying on or just above the shoulder angle. Young shells are even more *Fusus*-like, the whorls being sculptured with strong spirals and the posterior sinus is nearly lacking. In *occidentalis*, the form is broad with a large body-whorl, the upper surface of the whorls is practically smooth even in young shells, and the anal sinus is constantly deep and *Turris*-like. *Surcula thompsoni* appears to belong to the *Fusidæ* and provisionally may be placed in Vincent's genus *Clinuropsis*. *Surcula occidentalis* on the other hand, is decidedly more pleurotomoid than any of the described species and is here taken as the type of a new genus belonging with the *Turridæ*.

The relationship of "*Surcula*" *mayi* Hanna and Israelsky from Mancora is doubtful. Only the type specimen is known which is weathered and does not show the form of the growth lines. I am inclined to regard it as a fasciolaroid. Probably to this group of *Surcula-Fusus*-like shells should be included the *Euthriofusus spinosus* Suter¹⁵ from the Miocene of New Zealand.

Andicula occidentalis appears to be a true pleurotomoid differing from the above mentioned species by its deeper anal sinus, constantly situated on the shoulder angle. From true *Tur-*

²¹White, 1888, Archiv, Mus. Nacion, Rio de Janeiro, vol. 7, p. 135, pl. 18, figs. 1, 2.

²²Philippi, 1887, Die Tertiaren und Quartaren Versteinerungen Chiles, p. 37, pl. 1, fig. 8.

¹⁵Suter, 1917, Description of New Tertiary Mollusca occurring in New Zealand, Pa. Bull. No. 5, N. Zeal. Geol. Survey, p. 24, pl. 4, figs. 1, 2.

ricula (*Surcula*) as typified by the recent *P. javana* Linnaeus, *Andicula* differs by its larger size, fulguroid form, armed shoulder and deep *Turris*-like anal sinus. The smaller specimens of *occidentalis* closely resemble certain species of *Pleurotomella* Verrill, (for example *P. (Gymnobela) agonia* Dall¹⁶), but the genus *Pleurotomella* is typically a deep sea type more or less pyriform with a fairly high conic spire, a long, moderately curved anterior canal and the shoulder armed with strong, closely spaced spines or tubercles. The growth lines are very sinuous, forming a wide, deep and pronounced sinus on the armed shoulder. There is also a smaller sinus midway between the shoulder and the tip of the anterior canal.

Genus DRILLIA Gray (sensu lato)

Drillia parina, n. sp.

Plate 8, figs. 12, 13, 14

Shell thin, *Mitra*-like in form, with a long, pointed spire and slender, anterior canal; protoconch acute, pointed, smooth of about 4, convex whorls; post-nuclear whorls 4 or more, only slightly convex so that profile of the spire is nearly straight; sutures distinct, bordered on the anterior side by a spiral ridge; sutural fasciole fairly wide, shallow, bordered above by the sutural cord or ridge and scarcely differentiated below by the weak shouldering or angulation of the whorls; sculpture of the spire whorls consists of about 11, weak riblets between the fasciole and lower suture, but gradually fading out on the shoulder of the last whorl; the predominant sculpture is by beaded spirals which cover the whole surface except the sutural fasciole on which the spirals are simple; on the last whorl, there are 3 spirals (the lower heavy) on the sutural ridge, 5 simple spirals on the sutural fasciole and 14 or 15, beaded spirals on the surface below the shoulder to the tip of the anterior canal; anterior

¹⁶Dall, Bull. Mus. Comp. Zool., vol. 43, p. 278, pl. 1, fig. 6.

canal long, slender; columella smooth; anal sinus in the sutural fasciole.

Length 13.5 mm. (3 whorls); diameter 6 mm.; aperture 7 mm.

Length 17 mm. (estimated); aperture 9 mm. (estimated)

Remarks.— Our specimens of this interesting species are fragmentary. In form and sculpture, the shell resembles a *Scobinella* but the pillar appears to be perfectly smooth. The anterior canal is long and slender.

Locality and Geologic Occurrence.— Saman formation, Saman conglomerate near Negritos.

Genus DAPHNELLA Hinds

Daphnella salina, n. sp.

Plate 8, figs. 5, 10

Shell small, slender, the spire and aperture about equal in length; tip of spire broken in our specimens; sutures distinct between flattened or slightly convex whorls; surface is sculptured with strong, equal, spiral threads between wider intervals; these spirals number about 17 or 18 on the back of the last whorl and 4 or 5 on the spire whorls; in addition the spire whorls have strong, axial threads of the same size as the spirals but these become obsolete or irregular on the penultimate and last whorl; aperture narrowly elongate, the outer lip heavy and thickened with a shallow sinus near its posterior end; canal hardly differentiated and slightly recurved at the tip.

Height 12 mm. (incomplete); diameter 5.5 mm.; aperture 7.5 mm.

Height 14 mm. (estimated length if perfect)

Height 12 mm. (incomplete); diameter 5.5 mm.; aperture 8 mm.

Height 16 mm. estimated length)

Remarks.— This species closely resembles the figure of *D. bartschi* Dall²³ recent off the Lower Californian coast, but is larger, more coarsely sculptured and more slender.

Locality and Geologic Occurrence.— Saman formation, Saman conglomerate at Negritos.

Daphnella eupelia, n. sp.

Plate 8, fig. 2

Shell small, elevated with convex whorls and distinct sutures; protoconch unknown; post nuclear whorls preserved 3, evenly convex, the last or body whorl with descending sutures; body

²³Dall, 1919, Proc. U. S. Nat. Mus., vol. 56, p. 74, pl. 19, figs. 4, 5.

whorl sub-elliptical, the base or anterior portion evenly contracted or produced; sculpture consists of regular and strong spiral cords, the upper ones more or less nodulated by faint, longitudinal riblets, the earliest spire whorls preserved have about 5 spirals, increasing to 7 on the next, 8 on the penultimate and 16 or more on the body whorl; on the early whorls, the ribs are quite well developed, numerous (10 to 12), straight and pass from suture to suture; on the later whorls, the riblets are still more numerous, irregular and gradually vanish into the growth lines; aperture destroyed but showing remains of a much thickened outer lip.

Length 8 mm.; diameter 3.5 mm.

Remarks.— A small species with strongly convex whorls and fairly coarse spiral cords and fainter axial riblets; the outer lip was probably strongly thickened.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

Genus MANGELIA Risso (sensu lato)

Mangelia jabonillalensis, n. sp.

Plate 8, figs. 6, 8, 9

Shell small, fusoid, the spire and aperture about equal in length; spire high acute, composed of about 7, or 8, convex whorls between sharp, distinct sutures; protoconch conic, pointed of 4 or 5, smooth convex whorls which rapidly increase in size; on the last quarter turn of the final nuclear whorl, faint ribs make their appearance, shortly followed by spirals; post-nuclear whorls about 3 in number; these are sculptured with equal, regular, longitudinal ribs which pass from suture to suture and across the base of the last whorl to the anterior canal; they number about 15 on the body whorl; the ribs and interspaces are crossed by a primary set of spiral threads separated by wide banded intervals which carry 4 or more fine secondaries; canal of moderate length, slightly twisted and with a deep, anterior sinus; aperture lanceolate, the outer lip thin or thickened simply by the ribs.

Length 10.5 mm.; aperture 5 mm.; diameter 4.75.

Remarks.— This is a small *Phos*-like species abundant in the

Upper Restin of Jabonillal. The lip appears to be thin, or thickened simply by the ribs.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

Genus TURRICULA Schumacher (sensu lato)

Turricula bonilla

Plate 8, fig. 1

Shell small, with a fairly long spire and shorter aperture; protoconch acute, pointed, of 4, convex, smooth whorls rapidly passing on the last quarter turn into the post-nuclear stage; post-nuclear whorls 4, sculptured with ribs and fine spirals; sutures linear, distinct, bordered by a ridge or double cord; sutural fasciole present, sloping but not sharply limited on the lower side; post-nuclear whorls convex, roughly shouldered about the middle; last whorl is rather large, with a sloping base and a fairly long anterior canal; longitudinal sculpture of about 8 ribs or folds, which extend from the sutural cord to the lower suture, but fading out on the base of the last whorl; this sculpture is overrun by finer, wavy spiral threads, slightly finer on the fasciole; anal sinus indicated by the growth-lines lying in the sutural fasciole; anterior canal long, straight.

Length 7 mm.; diameter 2.5 mm.; aperture 2.75 mm.

Remarks.— The tip of the anterior canal is broken so that the length of the perfect shell was probably about 8 mm. In its form and in its long, straight, anterior canal, the species resembles a *Turricula*, and it is provisionally referred to that genus.

Locality and Geologic Occurrence.— Restin formation, Jabonillal.

Phylum MOLLUSCOIDEA

Class BRACHIOPODA Dumeril

Order TELOTHEMATA Beecher

Family MEGATHYRIDÆ Dall

Genus ARGYROTHECA Dall

***Argyrotheca berryi*, n. sp.**

Plate 1, figs. 9, 10, 11

Shell small, *Orthis*-like in form, inequivalve, thick and heavy; ventral valve largest, convex with a sharp pointed beak and wide cardinal area; dorsal valve flat, usually with a faint, medial furrow and practically no hinge area; anterior or hinge margin

nearly straight, the posterior well-rounded forming nearly a true circle, the width of the valves as a whole, slightly greater than the height; cardinal area, restricted almost entirely to the ventral valve is broadly trigonal, flattened to excavated, and with a wide deltidial opening, usually much eroded; internal characters concealed or badly eroded; surface smooth, but densely punctate, and in some specimens with very faint costæ.

Height 2.50 mm.; width 3.50 mm.; dorsal valve

Height 2.75 mm.; width 3.50 mm.; ventral valve

Thickness of both valves 1.50 mm.

Remarks.— *Argyrotheca berryi* is a small *Orthis*-like species quite abundant in the Saman conglomerate at Caletto Sal, associated with its typical fauna of *Liothyryna peruviana* Olsson and species of *Discocyclina* and *Asterocyclina*. Three other species of this genus are known from the American Eocene, *A. dalli* Aldrich²⁴, described from a right valve collected at Hatchetigbee Bluff Alabama, it is nearly twice the size of *berryi* and sub-circular in form; *A. dalli* Cooke²⁵ from the Upper Eocene of St. Bartholomew, a large coarsely ribbed species and *A. powersi* Gardner²⁶ from the Midway of Butler's salt dome Texas. *A. schur-cherti* Dall²⁷ occurs in the Chesapeake Miocene of Jackson's Bluff, Florida and several species are known in the recent American fauna.

The genus *Argyrotheca* is well represented in the European Tertiaries. Cossmann²⁸ figures 11 species from the Parisien Eocene and von Kœnen²⁹ 3 species and varieties from the Lower Oligocene of Northern Germany.

This species is named for Mr. E. Willard Berry of Johns Hopkins University.

Locality and Geologic Occurrence.— Saman formation, Caletto Sal.

²⁴Aldrich, 1911, Bull. Amer. Pal., vol. 5, 22, p. 13, pl. 5, figs. 9, 10.

²⁵Cooke, 1919, Carnegie Institution of Washington, No. 291, p. 152, pl. 16. figs. 5 a-c.

²⁶Gardner, 1925, Amer. Journ. Sci., 5th series, vol. 10, p. 134-138, figs. 1-8.

²⁷Dall, 1903, Trans. Wagner Free Inst., vol. 3, pt. 6, p. 1539, pl. 58, fig. 8.

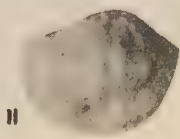
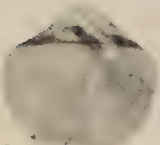
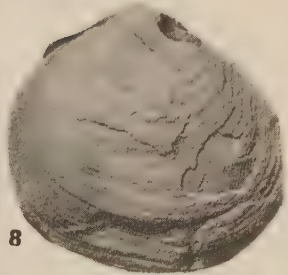
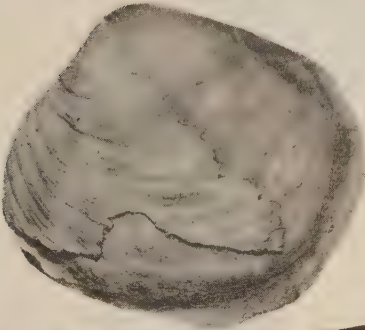
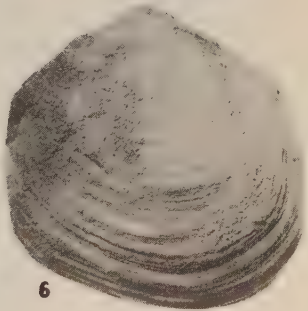
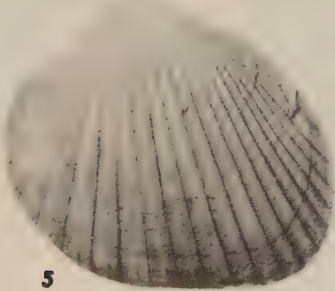
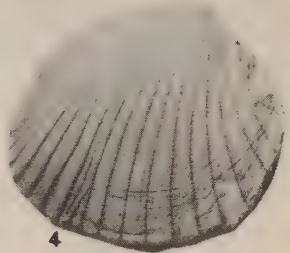
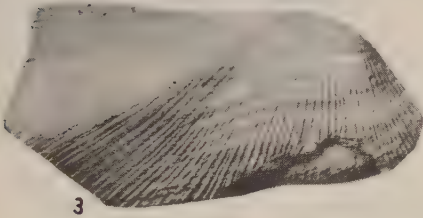
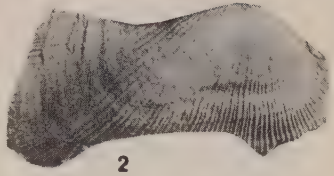
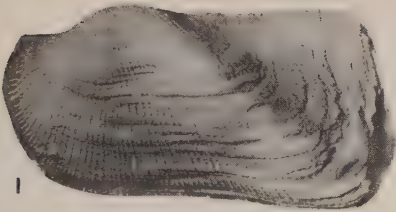
²⁸Cossmann and Pissarro, 1913, Icon, des Coquilles des Environs de Paris, pl. 62, figs. 5-1 to 5-11.

²⁹Kœnen, 1894, Abhandl. d. geol. Landesanstalt, Bd. X, Heft. 6, taf. 11C.

EXPLANATION OF PLATES

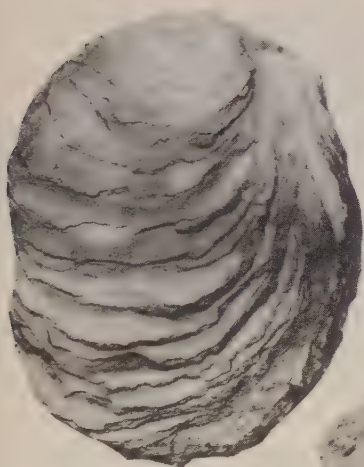
EXPLANATION OF PLATE 1

FIG.		PAGE
1.	<i>Arca</i> (<i>Barbatia</i>) <i>saladoensis</i> , n. sp. Holotype, length 21 mm. Restin formation, Que. Salado	4
2.	<i>Arca</i> (<i>Barbatia</i>) <i>saladoensis</i> , n. sp. Cotype, length 19 mm.	4
3.	<i>Arca</i> (<i>Barbatia</i>) <i>saladoensis</i> , n. sp. Cotype, length 23.5 mm.	4
4.	<i>Arca</i> (<i>Argina</i>) <i>samanensis</i> , n. sp. Cotype, length 23 mm. Saman formation, Casa Saman	5
5.	<i>Arca</i> (<i>Argina</i>) <i>samanensis</i> , n. sp. Holotype, length 21 mm. Saman formation, Casa Saman	5
6.	<i>Diplodonta caboblanca</i> , n. sp. Holotype, length 26 mm. Restin formation, Cabo Blanco	10
7.	<i>Lucina corbula</i> , n. sp. Holotype, length 34.5 mm. Restin formation, Que. Conventus	7
8.	<i>Diplodonta caboblanca</i> , n. sp. Cotype, length 23 mm.	10
9.	<i>Argyrotheca berryi</i> , n. sp. Cotype, width 2.5 mm. Saman formation, Caleta Sal.	34
10.	<i>Argyrotheca berryi</i> , n. sp. Holotype, width 3.5 mm.	34
11.	<i>Argyrotheca berryi</i> , n. sp. Cotype, width 2.5 mm.	34

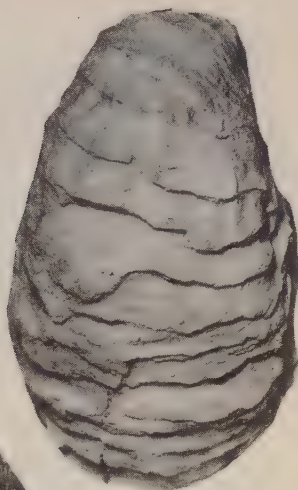


EXPLANATION OF PLATE 2

FIG.	PAGE
1. <i>Ostrea restinensis</i> , n. sp. Exterior of upper valve, length 78 mm. Restin formation, Restin.	6
2. <i>Ostrea restinensis</i> , n. sp. Exterior of lower valve. Holotype. Length 71 mm. Restin formation, Restin.	6
3. <i>Ostrea quiroga</i> , n. sp. Interior of upper valve, Holotype. Length 162 mm. Salina formation, Negritos.	6
4. <i>Ostrea quiroga</i> , n. sp. Exterior of lower valve, Cotype. Length 94 mm. Salina formation, Negritos.	6
5. <i>Ostrea quiroga</i> , n. sp. Interior of same specimen as figure 4	6



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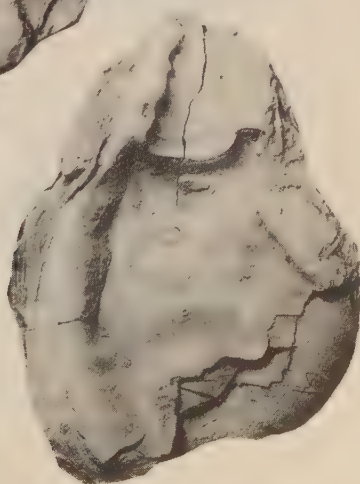
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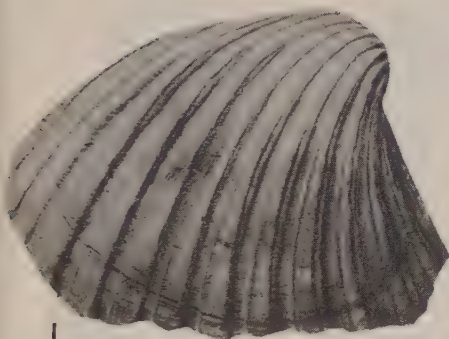
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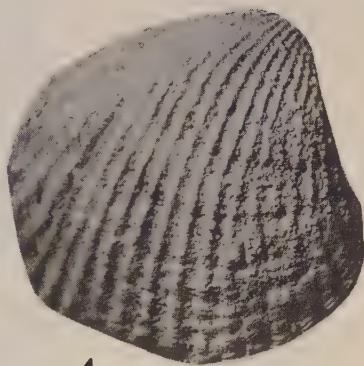
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EXPLANATION OF PLATE 3

FIG.		PAGE
1	<i>Venericardia planicosta</i> , var. <i>labreaensis</i> , n. var. Right valve, Cotype. Length 45 mm. Negritos formation, La Brea.	7
2	<i>Venericardia planicosta</i> , var. <i>labreaensis</i> , n. var. Left valve, Holotype. Length 36.5 mm. Negritos formation, La Brea.	7
3	<i>Phacoides (Miltha) conventus</i> , n. sp. Holotype. Length, 29 mm. Restin formation, Que. Conventus.	9
4	<i>Venericardia talara</i> , n. sp. Holotype, right valve. Length 31 mm. Restin formation, Negritos.	8
5	<i>Venericardia talara</i> , n. sp. Holotype, left valve.	8
6	<i>Cardium (Cerastoderma) himertum</i> , n. sp. Holotype. Length 20.5 mm. Restin formation, Que. Salado.	11



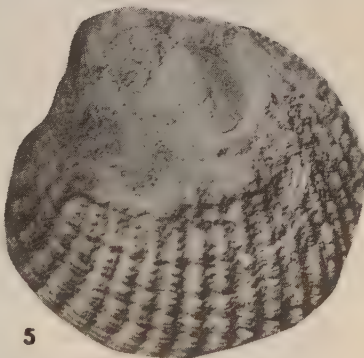
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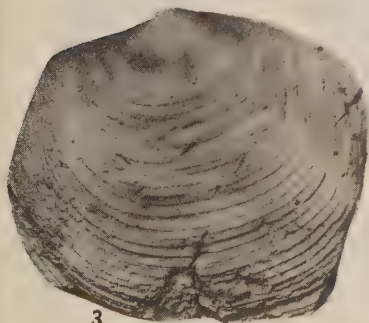
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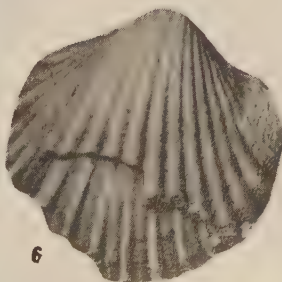
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EXPLANATION OF PLATE 4

FIG.	PAGE
1. <i>Cerithium læviusculum</i> Gabb. Ventral view of a normal specimen, with a single varix. About natural size. Saman formation. Paita.	15
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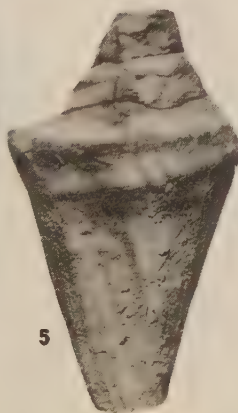


EXPLANATION OF PLATE 5

FIG.

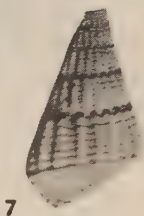
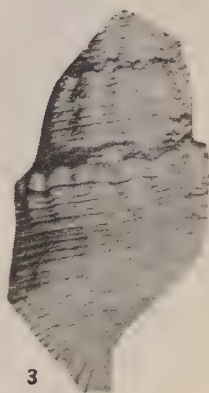
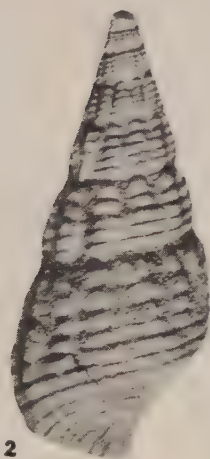
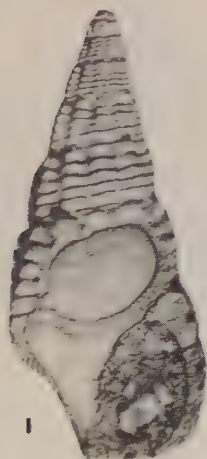
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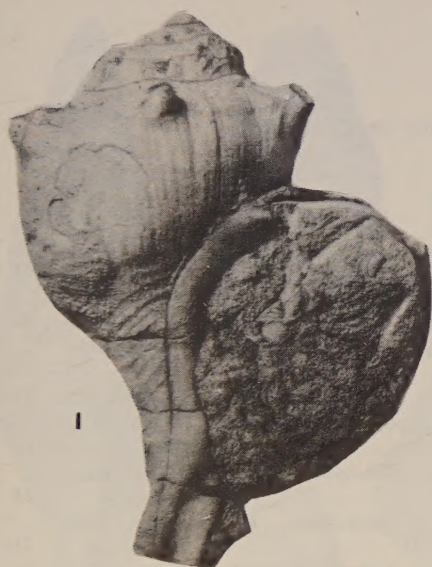
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